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Ridgaway, C. B.

Experiments in
evaporation.

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UNIVERSITY OF WYOMING.

Agricultural College Department.

WYOMING EXPERIMENT STATION,

LARAMIE, WYOMING.

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Experiments in Evaporation.

By C. B. RIDGAWAY.

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Monograph

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INTRODUCTION.

The two great questions which are of most importance to the agriculturist in this section of the country are: How may we best conserve and utilize the available water to the greatest advantage? and, How may we eliminate the surplus alkali from the soil?

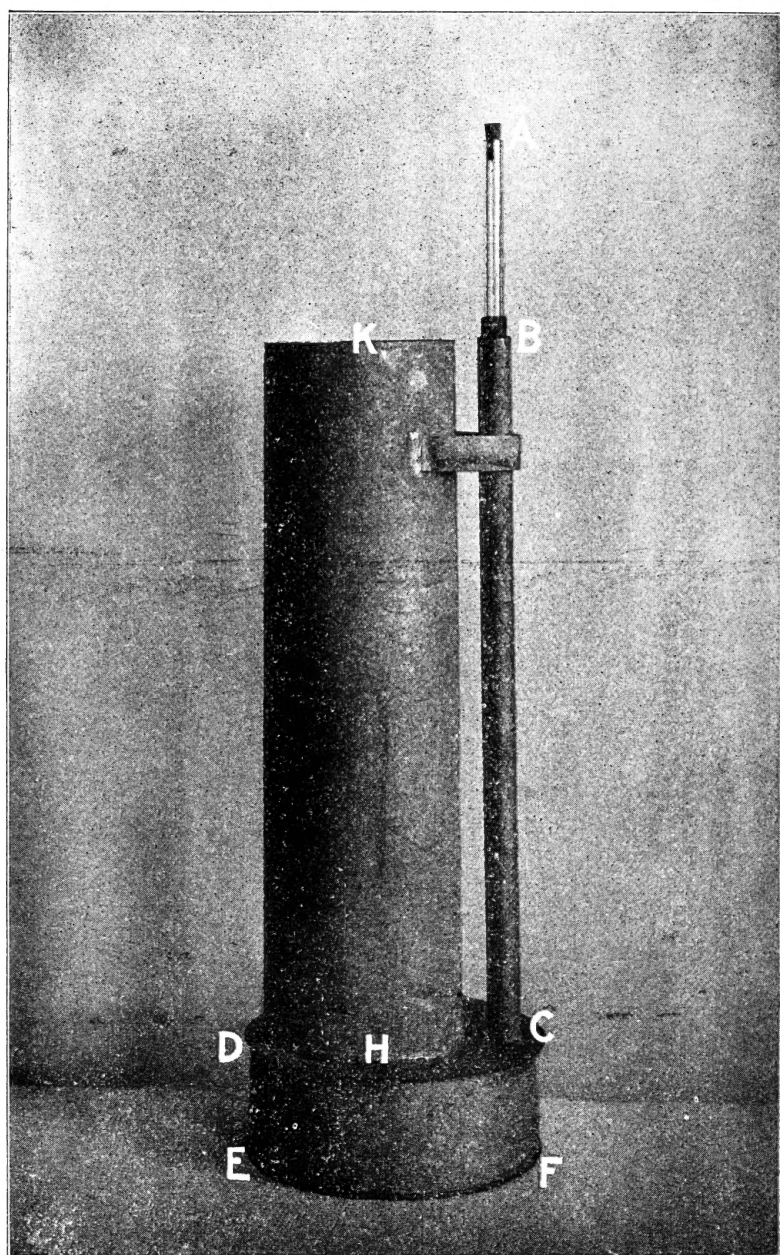
It was in the hope of throwing some light upon the solution of these great questions that the following experiments were undertaken.

I regret to state that the young man who took the observations for a few days, on account of the necessary absence of the regular observer, lost the records for two months of the year 1900. I have concluded, therefore, to use the records for 1901 only in reporting the amount of evaporation. The results in regard to the rise of alkali, however, will cover the period of two years.

The water used in these experiments was obtained from the artesian well near the University, and the amount of alkali contained therein was .639 grains per gallon as per analysis made by Professor E. E. Slosson, Chemist of the Station.*

I wish here to acknowledge my indebtedness to Mr. B. P. Fleming, Irrigation Engineer, for all of the data found in Table II.

*Bulletin No. 24, Wyo. Ag. Exp. Sta. Water Analyses.



Experiments in Evaporation.

The following were some of the questions which I hoped to partially answer by these experiments:

1. How rapidly does moisture evaporate from the soil when the level of water is kept at a certain distance from the surface by subirrigation?

2. What effect has stirring the soil once a week to certain depths upon the evaporation of moisture when the level of water is maintained at a constant depth?

3. What effect has subirrigation upon the rise of alkali?

4. What effect has alkali upon the evaporation of moisture when the level of water is kept at a certain depth from the surface?

For the purpose of investigating these questions I had constructed 15 pieces of apparatus similar to the one shown in the cut. D E F C is a drum, 9 inches in diameter and 4 inches deep, made of heavy galvanized sheet iron. K H is a tube of the same material, 26 inches long and 6 inches in diameter, extending to the bottom of the drum, and with its lower surface perforated with many holes so as to admit water freely from the drum.

This pipe was filled with soil in place on the experiment farm by driving the tube into the soil as far as possible, then with trowels and knives cutting the soil from around the tube and driving it down still further. The process was continued until the tube was entirely filled. The tube was then soldered into the drum around the rim at H.

The tube B C is of galvanized iron pipe soldered into the drum at C and fastened to the larger pipe by a support a little below B.

This apparatus was buried in the ground on the experiment plat so that the top of the tube H K was level with the surface of the soil. Thus I had the undisturbed soil from the farm buried in the ground with the top exposed to the wind, rain, and sunshine, and having the same temperature as the surrounding earth.

The tank, from which observations were taken of the amount of evaporation of moisture from the water surface, and the soil thermometers, for determining the temperature of the soil at various depths, were located about 16 feet from the buried tubes.

In the tube B C was put a small empty vial fitted with a rubber stopper. In the stopper was inserted an aluminum wire long enough to reach up to a certain mark on the glass tube B A when the vial was floating on the water kept at a certain level in the tube B C. The tube B A was calibrated so that 5.5 grams of water poured into the tube B C would cause the end of the wire to rise through one space. The upper end of the wire was bent at a right angle, and the lower end of the tube at B was almost closed by fusion, so that the pointer on the end of the wire could move up or down through the length of the tube but could not fall below the lower end B.

The level of water in the tube B C was kept at about the same height by pouring water from a graduate into the tube A B at 7 p. m. each day during the crop season of 1900. During the year 1901, the method of obtaining the amount of water used each day differed somewhat from the method used the previous year. A beaker nearly full of water was first carefully weighed, then enough water poured from it into the tube B C to bring the floating index up to the required mark; the beaker was again weighed and the amount in grams of water poured into the tube was ascertained and recorded. Very frequently the index would come above the proper mark, then an allowance had to be made for the excess poured in; an allowance also had to be made for the amount of evaporation the

next day. This, however, was very easily accomplished by means of the calibrated tube A B.

DATA IN REGARD TO THE DIFFERENT TUBES.

No. 1 was kept full of water to within 6 inches of the top.
No. 2 was kept full of water to within 12 inches of the top.
No. 3 was kept full of water to within 18 inches of the top.
No. 4 was kept full of water to within 22 inches of the top.
No. 5 was kept full of water to within 22 inches of the top and the surface stirred once a week to the depth of 2 inches.

No. 6 was kept full of water to within 22 inches of the top and the surface stirred once a week to the depth of 4 inches.

No. 7 was kept full of water to within 22 inches of the top and the surface stirred once a week to the depth of 6 inches.

In tubes 8, 9, 10, and 11 enough sodium carbonate in solution (5 per cent) was poured in A C to moisten each tube full of earth and leave the solution standing at the proper level, after which artesian well water was added each day. In tubes 12, 13, 14, and 15 a 10 per cent solution of sodium carbonate was added till all of the earth was moistened with the liquid, then water was poured in as in the other tubes.

No. 8 was kept full of water to within 6 inches of the top.

No. 9 was kept full of water to within 12 inches of the top.

No. 10 was kept full of water to within 18 inches of the top.

No. 11 was kept full of water to within 22 inches of the top.

No. 12 was kept full of water to within 6 inches of the top.

No. 13 was kept full of water to within 12 inches of the top.

No. 14 was kept full of water to within 18 inches of the top.

No. 15 was kept full of water to within 22 inches of the top.

In column 16, of Table No. I, the amount of evaporation from the free water surface will be found, while column 17 of the same table contains the amount of rainfall.

The amounts in Table No. I are recorded in linear inches, while those in Table No. II represent the per cent of alkali found in the soil at various depths.

The following conclusions were drawn from these experiments:

The evaporation from the surface of the soil with the level of water maintained at 6 inches below was 95 per cent, at 12 inches below it was 70 per cent, at 18 inches below it was 45 per cent, and at 22 inches below it was 35 per cent of what it was at the surface of the water in the evaporation tank.

Stirring the ground once a week to the depth of 2 inches retarded evaporation to the amount of 19 per cent, when stirred to a depth of 4 inches it was retarded 23 per cent, and when stirred to a depth of 6 inches evaporation was retarded 45 per cent. The water in all three of the pipes was maintained at a depth of 22 inches below the surface of the soil.

Evaporation was retarded 43 per cent when the soil contained .0597 per cent of alkali and the level of water was maintained at 6 inches below the surface. The amount of retardation was 55 per cent in soil containing .5116 per cent of alkali, and the level of water 12 inches below the surface. In soil containing .5375 per cent of alkali the amount of retardation was 50 per cent when the level of water was maintained at 18 inches below the surface; while the retardation was 57 per cent in soil containing .6205 per cent of alkali and the level of water kept at 22 inches below the surface. The amount of alkali is the average amount found in the entire 26 inches of soil.

More alkali was found in the first three inches than in any other three inches of the soil.

More alkali was found in the last two inches than in the three next above.

The following analysis of the soil used in these experiments was made by Professor E. E. Slosson in 1892, and published in Bulletin No. 6.

Chemical Analysis of the Soil of the Laramie Experiment Farm.

	Surface	Subsoil
Analysis of fine earth.	1-9 in.	9-18 in.
Insoluble matter	80.11	77.28
Soluble silica	2.78	1.92
Potash (K_2O) . . . . .	.60	.53
Soda (Na_2O) . . . . .	.65	.45
Lime (CaO)	1.14	3.77
Magnesia (MgO) . . . . .	.45	.08
Iron (Fe_2O_3)	2.79	2.49
Alumina (Al_2O_3)	4.95	4.71
Phosphoric acid (P_2O_5) . . . . .	.14	.15
Sulphuric acid (SO_3) . . . . .		.07
Carbonic acid (CO_2) . . . . .	.69	3.70
Moisture	1.87	1.24
Volatile and combustible matter	3.21	2.82
	99.38	99.21
Soluble in water . . . . .	.0829	.0464
Chlorine . . . . .	.001	.001

MAY, 1901.

TABLE 1—Evaporation.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
9	.232	.084	.167	.159	.067	.155	.281	.254	.130	.055	.030	.171	.046	.009	.000	.144	
10	.247	.256	.166	.029	.106	.060	.029	.253	.121	.035	.012	.066	.097	.015	.000	.288	
11	.221	.206	.142	.141	.000	.000	.004	.227	.109	.030	.022	.124	.086	.027	.000	.086	
12	.234	.190	.128	.140	.065	.030	.044	.129	.087	.050	.052	.128	.119	.060	.000	.108	
13	.237	.213	.137	.066	.038	.076	.108	.237	.107	.041	.090	.100	.065	.039	.021	.180	.020
14	.226	.215	.154	.182	.062	.066	.091	.200	.090	.041	.063	.085	.048	.081	.097	.120	
15	.176	.145	.095	.152	.040	.000	.022	.134	.062	.000	.000	.085	.000	.000	.000	.180	
16	.187	.145	.095	.058	.085	.000	.000	.219	.127	.024	.048	.131	.095	.024	.048	.144	.240
17	.251	.200	.123	.154	.080	.012	.260	.158	.077	.000	.108	.065	.051	.050	.000	.060	
18	.298	.209	.145	.182	.051	.077	.069	.283	.166	.068	.012	.144	.090	.054	.056	.252	
19	.381	.263	.315	.281	.092	.068	.000	.233	.166	.032	.000	.152	.115	.079	.057	.324	
20	.356	.270	.226	.177	.124	.108	.043	.200	.108	.039	.281	.339	.084	.059	.110	.240	
21	.401	.286	.333	.253	.093	.000	.054	.314	.128	.071	.097	.113	.093	.081	.073	.240	
22	.076	.076	.012	.000	.000	.000	.000	.658	.076	.000	.000	.150	.000	.000	.000	.288	.000
23	.172	.135	.044	.009	.071	.071	.059	.216	.141	.071	.051	.115	.000	.083	.012	.072	
24	.199	.160	.083	.076	.059	.024	.024	.022	.145	.071	.002	.115	.034	.000	.000	.204	
25	.137	.178	.119	.101	.210	.000	.000	.232	.160	.067	.034	.112	.086	.036	.012	.204	
26	.106	.078	.058	.072	.000	.000	.000	.203	.049	.000	.000	.052	.000	.000	.000	.036	.170
27	.288	.132	.095	.162	.036	.012	.003	.241	.174	.090	.036	.085	.036	.039	.036	.000	
28	.212	.179	.151	.237	.036	.024	.000	.222	.174	.065	.022	.079	.009	.015	.086	.132	
29	.271	.156	.111	.257	.049	.029	.012	.224	.162	.042	.012	.111	.059	.057	.056	.180	
30	.033	.024	.081	.052	.000	.100	.028	.084	.000	.000	.000	.057	.000	.000	.000	.192	.320
31	.000	.000	.000	.000	.000	.000	.000	.047	.000	.000	.000	.000	.000	.000	.000	.012	.000
Sum	4.733	3.724	2.939	2.972	1.414	.811	1.102	4.979	2.528	.934	1.008	2.567	1.355	.816	.660	5.052	2.250
Mean	.197	.155	.122	.124	.059	.034	.046	.207	.105	.039	.042	.106	.056	.034	.027	.210	

JUNE, 1901.

TABLE I (Continued)—*Evaporation.*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	.101	.075	.139	.024	.037	.071	.024	.000	.105	.084	.071	.055	.060	.063	.105	.093	.010
2	.109	.047	.023	.048	.048	.084	.024	.000	.084	.068	.084	.045	.070	.043	.048	.036	.150
3	.067	.035	.000	.012	.011	.022	.000	.000	.006	.000	.022	.037	.024	.000	.024	.120	.180
4	.000	.000	.000	.000	.000	.000	.000	.144	.000	.000	.000	.032	.000	.000	.000	.132	
5	.024	.047	.046	.047	.173	.129	.000	.034	.149	.166	.166	.062	.157	.153	.024	.180	
6	.280	.158	.046	.098	.040	.047	.000	.182	.155	.076	.071	.107	.104	.071	.012	.072	
7	.288	.153	.036	.079	.024	.035	.024	.230	.237	.059	.000	.053	.069	.047	.013	.204	
8	.384	.179	.091	.235	.030	.037	.037	.237	.171	.068	.044	.109	.124	.000	.038	.048	
9	.393	.288	.108	.097	.054	.129	.011	.244	.172	.081	.096	.106	.104	.047	.078	.348	
10	.199	.268	.207	.302	.190	.094	.000	.213	.157	.065	.086	.109	.097	.071	.000	.204	410
11	.406	.064	.019	.069	.000	.000	.000	.074	.029	.000	.000	.089	.000	.000	.000	.168	
12	.300	.140	.112	.104	.083	.048	.047	.251	.136	.112	.097	.069	.146	.159	.047	.048	
13	.295	.150	.139	.161	.130	.082	.024	.174	.131	.012	.084	.019	.104	.098	.054	.216	
14	.087	.042	.032	.000	.000	.000	.000	.089	.012	.000	.000	.045	.000	.000	.000	.036	910
15	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.000	.084	
16	.140	.000	.013	.037	.047	.071	.061	.103	.084	.000	.060	.023	.048	.048	.048	.006	
17	.218	.107	.023	.058	.071	.047	.058	.076	.094	.099	.106	.053	.085	.000	.000	.060	
18	.215	.064	.012	.013	.024	.058	.071	.135	.041	.080	.047	.031	.024	.034	.034	.216	
19	.336	.069	.024	.034	.024	.047	.013	.134	.081	.058	.071	.068	.061	.059	.036	.360	
20	.122	.124	.057	.010	.059	.046	.000	.161	.134	.073	.024	.058	.063	.072	.000	.372	
21	.301	.164	.125	.109	.036	.004	.047	.206	.108	.053	.107	.091	.162	.051	.000	.336	
22	.366	.213	.213	.167	.000	.000	.023	.346	.167	.139	.092	.111	.162	.050	.000	.276	
23	.323	.221	.191	.257	.024	.019	.000	.285	.195	.107	.070	.139	.128	.171	.164	.252	
24	.289	.416	.213	.132	.023	.016	.024	.277	.182	.087	.012	.169	.130	.104	.035	.324	
25	.270	.374	.321	.129	.028	.000	.023	.239	.146	.121	.125	.148	.142	.097	.000	.240	
26	.318	.301	.264	.206	.078	.000	.035	.025	.157	.068	.081	.125	.115	.099	.041	.348	
27	.309	.305	.266	.135	.059	.006	.110	.023	.370	.102	.108	.146	.089	.110	.004	.204	
28	.293	.358	.307	.151	.078	.052	.082	.192	.146	.082	.110	.139	.130	.136	.118	.420	
29	.469	.308	.407	.228	.022	.087	.023	.192	.109	.078	.000	.128	.099	.064	.060	.252	.070
Sum	7.412	4.900	3.162	2.942	1.395	1.231	.679	4.377	3.578	1.928	1.834	2.366	2.537	1.927	1.235	6.180	1.730
Mean	.247	.163	.105	.098	.046	.041	.023	.145	.119	.064	.061	.078	.084	.064	.041	.206	

JULY, 1901.

TABLE I (Continued)—*Evaporation.*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	273	274	266	267	087	012	024	254	166	060	073	110	101	070	121	336	
2	284	323	183	099	047	038	023	175	145	058	036	124	088	139	151	150	
3	274	356	167	138	057	055	004	249	185	088	087	113	137	102	083	516	
4	352	371	378	190	058	106	007	291	214	154	118	143	139	124	115	348	
5	372	308	367	156	130	011	023	208	208	070	068	136	127	095	095	288	
6	286	246	251	164	045	019	012	273	127	067	111	144	131	159	011	312	
7	172	487	280	112	112	000	012	205	150	144	372	136	088	124	012	396	
8	320	302	195	146	113	108	024	021	129	085	139	148	153	000	026	348	
9	233	262	182	069	067	000	012	167	119	064	036	112	054	078	064	096	
10	164	183	162	059	054	063	037	158	121	045	007	064	065	064	000	024	
11	272	226	250	143	025	075	001	226	149	074	040	101	120	064	051	252	
12	296	300	215	101	026	132	036	248	130	099	081	127	137	101	112	240	
13	224	272	220	199	211	050	013	220	246	127	129	010	088	128	001	336	
14	233	272	304	083	071	024	046	206	134	039	087	120	178	089	109	288	
15	134	004	060	027	213	037	000	072	000	198	110	080	108	000	097	380	320
16	302	206	082	078	087	102	004	012	138	209	157	111	108	000	000	276	
17	323	194	125	101	099	141	101	107	178	280	257	152	154	058	054	242	
18	291	465	089	061	111	137	042	125	368	326	235	129	179	080	000	456	
19	283	163	077	017	093	135	121	111	280	272	112	164	166	076	043	228	
20	267	182	127	101	106	132	141	130	225	310	447	116	169	048	069	336	
21	214	181	127	098	131	146	129	071	334	349	218	131	090	039	065	348	
22	259	185	120	061	072	141	121	073	352	347	352	201	037	097	073	348	
23	249	140	088	095	078	089	101	122	319	315	104	100	071	000	000	312	
24	227	155	080	073	136	098	007	106	336	265	221	169	043	070	039	240	
25	170	136	062	056	071	096	081	063	239	218	190	054	066	038	060	216	
26	156	124	079	065	042	096	095	043	217	243	168	117	032	070	000	336	
27	201	092	071	060	053	081	048	129	251	240	181	117	058	044	000	252	
28	218	145	087	065	069	065	097	125	258	221	118	057	060	069	052	336	
29	206	108	080	014	949	789	089	125	274	257	172	031	031	000	065	312	
30	227	150	085	118	073	112	069	091	298	278	216	392	088	058	042	276	
31	395	126	090	071	060	115	071	086	276	306	215	144	035	097	032	444	
Sum.	8,079	7,007	4,949	3,089	3,546	2,541	1,729	4,457	6,536	5,808	5,147	4,303	3,023	2,240	1,686	9,194	
Mean	260	226	159	99	114	82	65	143	211	189	166	139	97	72	54	280	

Experiments in Evaporation.

TABLE I (Continued)—*Evaporation.*

AUGUST, 1901.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	.202	.172	.106	.090	.047	.065	.088	.096	.330	.300	.114	.082	.024	.000	.040	.384	
2	.166	.101	.088	.043	.054	.124	.091	.136	.276	.295	.229	.117	.045	.035	.012	.348	
3	.116	.073	.031	.079	.049	.000	.091	.052	.172	.167	.170	.135	.061	.019	.081	.120	.080
4	.181	.074	.035	.036	.049	.040	.014	.031	.249	.196	.153	.095	.025	.000	.022	.228	
5	.200	.108	.038	.051	.053	.114	.105	.066	.230	.208	.140	.074	.033	.070	.032	.696	
6	.101	.054	.023	.048	.054	.039	.041	.046	.139	.151	.117	.051	.042	.051	.063	.324	.120
7	.300	.093	.043	.000	.054	.026	.034	.037	.183	.173	.169	.047	.011	.043	.000	.168	
8	.194	.094	.022	.046	.047	.030	.016	.033	.200	.196	.146	.061	.056	.058	.008	.228	
9	.183	.111	.069	.053	.052	.075	.033	.043	.081	.147	.094	.121	.066	.029	.032	.108	.030
10	.156	.080	.000	.012	.155	.012	.000	.003	.198	.174	.086	.142	.056	.071	.018	.348	.100
11	.297	.177	.056	.012	.045	.044	.026	.051	.252	.031	.103	.106	.022	.025	.047	.228	
12	.254	.183	.074	.068	.047	.085	.079	.116	.230	.181	.103	.065	.061	.009	.018	.396	
13	.213	.156	.071	.083	.037	.061	.049	.036	.259	.205	.121	.083	.045	.046	.033	.216	.020
14	.219	.139	.039	.074	.061	.114	.076	.036	.201	.217	.224	.088	.081	.027	.040	.120	
15	.197	.145	.069	.077	.030	.069	.076	.085	.176	.167	.110	.090	.051	.012	.041	.264	
16	.161	.123	.040	.036	.038	.054	.086	.086	.220	.227	.205	.071	.092	.099	.032	.048	
17	.233	.129	.067	.078	.129	.054	.086	.041	.465	.207	.152	.092	.000	.000	.000	.048	.500
18	.218	.131	.075	.054	.031	.137	.069	.000	.000	.000	.024	.071	.031	.036	.000	.072	.030
19	.030	.000	.000	.000	.000	.000	.000	.000	.000	.123	.071	.000	.000	.000	.000	.068	
20	.139	.028	.109	.069	.045	.100	.038	.036	.091	.101	.043	.036	.059	.036	.024	.204	
21	.115	.069	.036	.000	.028	.024	.000	.000	.099	.111	.043	.000	.118	.047	.024	.060	
22	.109	.071	.071	.028	.032	.071	.071	.000	.043	.083	.054	.012	.036	.000	.012	.180	
23	.103	.083	.016	.000	.037	.037	.000	.036	.123	.146	.082	.078	.012	.012	.012	.132	
24	.182	.106	.074	.048	.031	.039	.039	.000	.148	.144	.087	.135	.000	.000	.000	.156	
25	.163	.136	.052	.036	.046	.090	.024	.012	.187	.144	.087	.103	.000	.000	.000	.086	
26	.179	.120	.047	.012	.031	.038	.024	.000	.157	.139	.129	.118	.177	.061	.000	.086	
27	.148	.106	.034	.000	.048	.065	.056	.058	.163	.155	.125	.078	.140	.000	.033	.132	
28	.159	.114	.055	.000	.058	.079	.033	.033	.163	.155	.125	.078	.140	.000	.033	.132	
29	.183	.157	.036	.039	.026	.064	.030	.012	.205	.161	.086	.132	.049	.032	.000	.120	
30	.094	.033	.000	.041	.059	.047	.047	.067	.128	.107	.073	.046	.030	.040	.000	.132	
31	.154	.112	.031	.044	.124	.037	.035	.067	.139	.143	.076	.082	.030	.000	.032	.132	
Sum	5.187	3.376	1.609	1.218	1.649	1.815	1.356	1.459	5.523	4.986	3.502	2.386	1.999	1.340	.680	5.784	1.110
Mean	.167	.109	.052	.039	.053	.058	.043	.047	.178	.161	.113	.077	.064	.043	.022	.187	

SEPTEMBER, 1901.

TABLE I (Concluded)—*Evaporation.*

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1.	.160	.100	.064	.060	.038	.038	.062	.021	.188	.173	.151	.126	.050	.081	.000	.144	
2.	.187	.164	.060	.049	.043	.044	.141	.100	.235	.168	.112	.087	.070	.055	.000	.264	
3.	.131	.080	.030	.000	.043	.065	.012	.000	.015	.144	.107	.094	.029	.045	.039	.000	
4.	.157	.105	.037	.049	.045	.037	.086	.082	.183	.164	.086	.087	.037	.000	.000	.216	
5.	.159	.119	.079	.000	.046	.039	.045	.015	.220	.187	.108	.031	.037	.000	.000	.300	
6.	.105	.132	.052	.046	.039	.065	.042	.062	.198	.192	.147	.188	.086	.032	.036	.156	
7.	.180	.110	.061	.065	.030	.094	.042	.043	.194	.181	.115	.061	.000	.044	.012	.228	
8.	.164	.130	.067	.051	.045	.065	.080	.052	.207	.194	.136	.129	.088	.051	.012	.204	
9.	.017	.117	.083	.064	.035	.119	.037	.035	.166	.170	.108	.089	.043	.035	.028	.192	
10.	.134	.093	.022	.060	.014	.069	.081	.065	.194	.183	.119	.056	.023	.033	.026	.240	
11.	.193	.101	.039	.000	.053	.078	.051	.047	.174	.171	.101	.088	.045	.023	.019	.180	
12.	.142	.080	.057	.042	.022	.078	.085	.023	.137	.171	.101	.067	.000	.000	.022	.216	
13.	.146	.110	.032	.017	.039	.099	.022	.012	.176	.146	.101	.091	.000	.000	.028	.132	
14.	.155	.073	.030	.033	.039	.101	.036	.058	.200	.198	.151	.091	.000	.048	.027	.264	
15.	.211	.137	.074	.032	.039	.052	.047	.037	.178	.155	.088	.078	.000	.042	.029	.168	
16.	.172	.072	.050	.034	.052	.090	.038	.069	.151	.154	.102	.046	.041	.048	.037	.204	
17.	.144	.086	.036	.069	.030	.063	.032	.027	.151	.152	.129	.086	.036	.040	.037	.120	
18.	.142	.089	.047	.000	.024	.101	.032	.012	.159	.141	.129	.076	.012	.024	.000	.120	
19.	.147	.086	.040	.038	.030	.054	.015	.040	.163	.154	.091	.062	.017	.000	.036	.312	
20.	.165	.070	.018	.005	.037	.053	.046	.024	.165	.168	.120	.028	.026	.067	.000	.252	
21.	.150	.078	.039	.000	.000	.099	.073	.054	.185	.218	.108	.121	.030	.000	.036	.192	
22.	.235	.097	.058	.075	.047	.037	.033	.041	.183	.174	.153	.086	.000	.039	.054	.276	
23.	.188	.302	.039	.067	.037	.097	.041	.000	.211	.138	.117	.044	.067	.073	.000	.240	
24.	.177	.248	.061	.015	.104	.116	.032	.000	.174	.162	.131	.060	.000	.000	.037	.228	
25.	.172	.000	.093	.054	.018	.116	.029	.000	.138	.130	.069	.047	.032	.039	.026	.216	
26.	.179	.069	.090	.000	.019	.082	.054	.060	.138	.150	.101	.050	.000	.041	.000	.192	
27.	.151	.097	.091	.063	.028	.106	.065	.000	.129	.155	.071	.071	.000	.000	.022	.132	
28.	.124	.064	.051	.069	.035	.069	.090	.074	.108	.137	.083	.062	.056	.041	.000	.180	
29.	.160	.074	.060	.049	.045	.049	.056	.000	.156	.138	.030	.062	.000	.041	.000	.180	
30.	.194	.000	.080	.028	.000	.123	.000	.065	.186	.139	.141	.055	.067	.046	.011	.120	
Sum.	4.831	3.182	1.692	1.139	1.129	2.356	1.305	1.177	5.093	4.663	3.437	2.770	1.152	1.041	.021	5.892	.09
Mean	.161	.106	.056	.038	.038	.078	.043	.039	.169	.155	.115	.092	.038	.035	.021	.196	
Mean for 5 months	.206	.152	.099	.077	.062	.059	.042	.116	.156	.121	.099	.098	.068	.049	.033	.216	

TABLE II—*Per cent of Alkali.*

Depth in inches	8	9	10	11	12	13	14	15
3. . . . .	.1232	.4972	.6144	1.48	.2076	1.7916	.9724	1.2492
6. . . . .	.1044	.2176	.2728	.5560	.1924	.7048	.6104	.6708
9. . . . .	.0360	.1348	.1552	.3000	.1928	.4048	.5824	.5904
12. . . . .	.0480	.1516	.2048	.2316	.2244	.2544	.5596	.5752
15. . . . .	.0472	.0912	.2660	.1360	.2236	.2468	.3784	.5000
18. . . . .	.0404	.0380	.2064	.1688	.2648	.2168	.4180	.5140
22. . . . .	.0376	.0316	.2064	.3224	.2616	.2344	.2924	.4024
25. . . . .	.0412	.0360	.1796	.3256	.1400	.2392	.4904	.4620
Sum4780	1.1980	4.3040	4.9640	1.7072	4.0928	2.1156	3.5205
Mean.0597	.1497	.2644	.4401	.2134	.5116	.5375	.6205

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